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# ENVIRONMENTAL PROBLEMS AND COMMODITY TRADE IN THE COMMONWEALTH OF INDEPENDENT STATES: AN OVERVIEW AND THE CASE OF COTTON AND RICE IN THE ARAL SEA REGION

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## Introduction

1. The issue of sustainable natural resources management is a key element of the process of transition to market structures in most of the newly independent States that made up the former Soviet Union. The reason for this is twofold: first, the structure of the Soviet economy had depended heavily on those branches which exploited natural resources.[1] Industry, mining and construction accounted for approximately 45 per cent of value-added in the former USSR, while for most middle and high income countries it was less than 40 per cent.[2] The primary economy in the USSR once absorbed approximately 30 per cent of materials, energy and manpower resources, almost 40 per cent of capital investment, and accounted for about 35 per cent of the fixed assets of the country. By way of comparison, for most developed countries, these indicators are in the range of 10 to 15 per cent.[3] What is more important is that the composition of industrial production was severely biased towards industries which were not only major consumers of natural resources but also key sources of pollution. Secondly, primary commodities have been, and for quite some time, will remain the principal source of export revenues. Primary commodities, including fuel, accounted for between 50 and 60 per cent of export revenues of the former USSR in the post-1973/74 period[4] but will undoubtedly also shape the trade flows among the newly independent States of the former USSR.[5]

2. This paper analyses some of the main environmental problems of commodity production and commodity trade in the countries that made up the former Soviet Union. Particular emphasis is placed on the situation in the Central Asian republics surrounding the Aral Sea, and the possible impact of this situation on cotton and rice trade. In particular, the paper attempts to answer the following questions:

- How bad are the environmental conditions as a consequence of an overdeveloped primary sector relative to countries with similar income and industry base?
- What is the socialist legacy in the area of natural resources management?
- How much can the transition to market economies help in shaping sustainable management of natural resources?
- What is the interrelationship between irrigation-based cotton- and rice-growing and the desiccation of the Aral Sea in Central Asia?
- What are the ecological and commodity trade consequences of the water management problems in the Aral Sea Basin?

## I. Sustainable Resource Management and Economic Transition in the Former USSR

### A. Environmental conditions and natural resources management - the legacy of the past

3. Evidence suggests that, by and large, the environmental problems of the countries which made up the Soviet Union were no worse than those of Western Europe or North America some 20 or 30 years ago. At that time, conditions in the coal and steel communities of the eastern United States, Japan, Germany's Ruhr and South Wales in the United Kingdom were little different from those found in similar communities of the Commonwealth of Independent States (CIS) today.[6] Although international comparisons of overall environmental conditions are difficult in the light of differences in absorptive capacities, available

assessments suggest that the overall air and water pollution in the countries of the CIS tends to be higher than in developed Western countries. Likewise, the situation of nuclear waste and radiation is much worse in many regions of the CIS. Conversely, the ecological situation seems to be less serious in such areas as soil degradation, disposal of solid and hazardous wastes, and nature conservation.[7]

4. A major factor which had hindered the appreciation of the need for sustainable resources management before the mid-1980s was the doctrine derived from the Marxist labour theory of value[8] that natural resources had a very low value and thus a low price because little labour was expended on their extraction. Furthermore, although the concept of a natural resource rent did exist within Marxist value and price theories (the so-called absolute rent) it was not, or was only half-heartedly translated into practice.[9] Such thinking led to a situation where the prices of raw materials reflected neither their scarcity value nor their environmental costs.[10] Under the labour theory of value, even extraction costs were often understated in the light of the high capital intensiveness. Although the effects of price distortions have been acknowledged in all newly independent States, price subsidies, in particular for energy products, persist in many cases. In Russia, for example, price and export controls held prices of energy products to less than one-fourth of world prices in mid-1993.[11]

5. A second factor which had discouraged sustainable resource management stemmed from the fact that the fulfilment of formal plans was not assessed on the basis of profit made but rather according to gross output and sales.[12] Gross output and sales may be increased in two ways: on the one hand, by enhancing efficiency of material use, i.e. producing more and/or better products from the same amount of input; on the other hand, by simply expanding the throughput of materials without any improvement in efficiency. As there was little incentive for producers to improve efficiency to fulfil the plan of gross sales, most factories resorted to expanding throughput. Material costs in Soviet industry accounted for about 85 per cent of total outlays on average.[13] This points to a wastage of resources which became a symptomatic facet of the Soviet economy.

6. Low raw-material prices and the incentive to increase throughput manifested themselves in a highly inefficient use of natural resources, i.e. a far too high input of natural resources was required to produce one unit of product. In the case of energy intensity for example, in the mid-1980s, the USSR reached a ratio which was twice as high as that of the United States and three times higher than that of Germany and Japan.[14] A high intensity of materials use does not necessarily go hand in hand with higher pollution, while such intensity does require a higher volume of resource extraction; extraction and processing can be conducted in such a way that environmental conditions do not deteriorate. In the former USSR, however, the high intensity of materials use was also associated with wastage of materials and high pollution levels. This "squandering" of natural resources points not only to the deformed structure of the economy but also to a potential for its transformation.

7. As for the relationship between natural resources management and the environment, the lop-sided structure of the USSR economy led to a vicious circle. On the one hand, the over-development of the raw materials industries was giving rise to large-scale disruption of natural systems, the expansion of primary processing plants responsible for the largest emissions of pollutants, the generation of gigantic amounts of waste from mining and so forth. On the other hand, excessive emphasis placed on raw material extracting and processing

industries retarded the development of modern sectors of the economy, adoption of new technologies and structural change, which could have contributed to a fundamental reduction of raw material intensity and less environmental damage.

8. Other remnants from the past arose from the institutional framework which rendered implementation of environmental controls and rehabilitation measures very difficult. Authority on environmental matters was often dispersed among several federal and state ministries. Even a formally balanced plan all too often proved unworkable for meeting environmental targets because of supply breakdowns or the fact that the details of the financial part of the plan did not correspond exactly to the relevant material balances. In the case of environmental protection activities, such a mismatch was especially frequent: even when money was available, it was often impossible to place orders for equipment or monitoring instruments.[15] These factors will continue to affect the situation for some time. On the one hand, the experience is engraved in the minds of people and, on the other hand, it is tangible in the form of an insufficient stock of environmental protection and monitoring equipment.

9. The absence of an effective tax system readily available to the newly independent States is a further hurdle in the efforts to curb specific harmful environmental effects of commodity production and processing. Accountability for environmental damage did not exist in the past and now has to be introduced at a time when most enterprises are wrestling with difficult price adjustments and the consequences of galloping inflation.

10. The case of the Aral Sea region, which is discussed in some detail below, is a glaring example of over-intensive use of a natural resource, water, in order to expand the production of an export crop, cotton, without regard for the environmental consequences.

## B. Resources management consequences and environmental implications of economic reform

11. Overcoming the legacy of this past neglect necessitates the removal of obstacles to effective resource management and a shift towards pollution abatement. This is the justification for the argument that environmental and economic reforms must proceed hand in hand. Priority items of reform programmes relevant to environmental improvement seem to be price and tax changes which will give proper economic signals, the introduction of private property rights, the overhaul of the outdated and one-sided economic structure and the liberalization of trade.[16]

12. The most important task in terms of both conservation of natural resources and pollution abatement is to eliminate or at least strongly restrain explicit and implicit subsidies encouraging the consumption of natural resources, thus promoting conservation and more careful use of resource-based products. Such price increases, which are typically in the order of several hundred per cent, will constitute powerful and lasting incentives for the implementation of efficient and sustainable natural resource management allowing, on the one hand, resource conservation and, on the other, a reduction in pollution. To be successful in terms of pollution abatement, price policies will have to be supplemented by an effective system of environmental surveillance. According to World Bank estimates, aggregate emissions into air, for example, could markedly drop by the end of the century if energy

prices were to be lifted to Western European levels and if stricter environmental controls were applied to half the capital stock. Specifically, particulates and sulphur dioxide emissions could drop by as much as 75 per cent.[17]

13. If the widely accepted polluter pays principle is to be taken as the basis for reducing pollution levels, the introduction of private property rights and the enhancement of power of local governments over public property is called for. This will also be a crucial step towards resource preservation as it will encourage owners to realize natural resource rents.

14. Overhauling of the one-sided, resource-inefficient industrial structure would have a major effect on resource use. Restructuring would involve structural changes which could raise the processing efficiency of materials, leading to greater resource conservation. This may imply the outright demise of entire enterprises in the economy. Particularly affected would be large heavy industrial sectors such as steel making, the non-ferrous metal industry and chemical branches. Improvements there would not only enhance resource conservation but also reduce pollution. It needs to be borne in mind, however, that although these industries may be inefficient by Western standards, they might be performing relatively well compared to other industries in the former USSR. Moreover, in many newly independent States, tangible alternatives do not exist or might even be socially unacceptable. Those enterprises that are performing relatively well economically in spite of poor environmental records may not be expected to shut down rapidly (see box on the case of aluminium). Therefore the reduction in resource use and the decline in pollution may be rather slow in the initial phase of the transition.

15. Trade liberalization will also help in reducing pollution. As for imports, enterprises will have the opportunity to choose those materials which suit the production process and the environmental targets best. Export-wise, commodity producers are free to earn foreign exchange in order to acquire equipment which can gradually improve the environmental record of materials-processing and extraction.

## II. Trade and Environmental Issues in the Transition Period

16. As far as trade is concerned, data recording problems and barter trade make it very difficult to interpret the already scarce empirical information available. In the past, Soviet foreign trade was highly concentrated and conducted through specialized, mostly Moscow-based foreign trade organizations. After the break-up of the Soviet Union, exporters and importers in the newly-emerging countries began to establish direct links with international markets. Custom borders in a physical sense, however, scarcely exist in a large part of the post-Soviet economic space, and it is thus virtually impossible to distinguish intra-CIS from trade flows with other countries. For barter trade, although a rising proportion of the CIS countries' foreign trade is now formally conducted in convertible currencies, the share of barter transactions appears to be rising even faster.[18] These linked export-import deals pose special valuation problems. As long as current domestic prices, exchange rates and trade regulations remain unchanged, large profits can be earned from re-exporting relatively cheap raw materials obtained at artificially low, state-fixed prices into a country where prices are free or where regulations allow an advantageous rouble/dollar conversion rate.[19] Foreign trade data may therefore under-estimate actual flows if traders, who intend to evade capital export

prohibitions, manage to by-pass frontier controls. In essence, what is happening is a "creation of trade" in the wake of a dual change in the regional pattern of trade: on the one hand, trade that used to be conducted domestically has become internationalized since the break-up of the former USSR. On the other hand, trade liberalization allows input procurement from cheaper or qualitatively better foreign sources and enables producers to export whenever they enjoy a comparative advantage.[20]

17. As far as commodity exports to the West are concerned, the volume of non-ferrous metal exports was markedly higher in 1992 - 1993.[21] The rapid depreciation (some observers talk about under-valuation[22]) of the rouble, the demise of raw-material intensive branches and the under-utilization of industrial capacities, in general,[23] as well as the low level of domestic raw material prices (in many cases still well below world market levels) lead some observers to predict a "Kuwaitization" of the CIS economies, i.e. a specialization in raw materials production in the wake of a sharp cut in industrial capacity.[24] A review of the behaviour of CIS aluminium exports in the period 1992 - 1994 seems to confirm this prediction at least partially (see box). Furthermore, the case of the aluminium industry illustrates the probability that, for quite some time in the period of transition, the containment of environmental damage may attract less attention than the avoidance of the consequences of a steep decline in total industrial output.

**The Case of Aluminium**

Preliminary data suggest that domestic aluminium demand in the CIS has steeply dropped. In Russia alone, it contracted from about 2.4 million metric tons in 1990 to approximately 0.7 million metric tons in 1993, while aluminium output remained at about 2.8 million metric tons (with an overall capacity of about 3.5 million metric tons). Western trade statistics show that CIS aluminium exports to the West rose from about 82,000 metric tons in 1990 to 443,000 in 1991, about 1 million in 1992, and 1.5 million metric ton in 1993. The export drive became so strong that aluminium shortages appeared in the CIS. The fish canning industries in Russia and the Ukraine, for instance, clamoured against aluminium shortages as, among other things, the metal is used in the canning of caviar.

Only two smelters, in Krasnoyarsk (with a production of 800,000 metric tons per year) and Bratsk (1 million metric tons annually), have been closed so far. Each emitted approximately 6,000 metric tons of fluorine annually, about 20 times the level permitted by former Soviet standards. Part of the hard currency proceeds earned from higher exports will certainly be used in low-cost schemes to cut drastically pollution from most aluminium smelters in the CIS in a relatively short period of time. Experts estimate these costs at about 600 million US dollars. In the meantime, however, there is the risk that modernized and environmentally sounder smelters in Western Europe might have to close in the wake of a flood of CIS exports stemming from far more polluting smelters. This risk was one of the motives that prompted the Commission of the European Communities in August 1993 to introduce short-term restrictions on aluminium imports from the CIS. The imports were curtailed to a total of 60,000 metric tons between August and November 1993 and a further 45,000 metric tons from December 1993 to February 1994. A Memorandum of Understanding (MOU), signed by representatives of the USA, Canada, Russia, Norway, Australia and the European Union in February led to the expiration of the import quota. The MOU provides for a 10 per cent cut of worldwide aluminium production. Russia committed itself to a cut of 500,000 metric tons of which 200,000 seem to have already been idled. The MOU also includes a commitment by Western governments to provide assistance in restructuring the Russian aluminium industry.

**Sources**: Financial Times, Metals Week, MBM Aluminium Supplement, September 1994

## III. The Environmental Destruction in the Aral Sea Basin in the Wake of Massive Irrigation-based Growing of Cotton and Rice in the Newly Independent Central Asian Republics

18. The question of the interrelationship between commodity production and ecological conditions is a major issue in connection with cotton and rice in the Aral Sea Basin. The case has been documented in some detail and offers some lessons of a general kind.

### A. Genesis of the problem

19. The changes in ecological conditions in Central Asia[25] and Kazakhstan began in the late 1950s with the massive cultivation of cotton, and later rice. During the last three decades, Central Asia and Kazakhstan accounted for about 90 per cent of the USSR's cotton production and about half of its rice harvest. The goal then was to make the USSR self-sufficient in cotton production at the national level, and to expand textile production in factories beyond Central Asia. It was thought that the production increase would meet rising domestic demand for clothing material and could also boost cotton exports. As can be seen from figure 1, cotton production almost doubled in Central Asia during the 1960s and 1970s. At the same time, USSR cotton exports almost tripled, keeping the country in the top league of the world's biggest cotton exporters.[26] Cotton production has been one of the most important sectors of the economies of Tadjikistan, Turkmenistan and Uzbekistan[27]; cotton is widely grown as well in Kazakhstan and Kyrgyzstan.

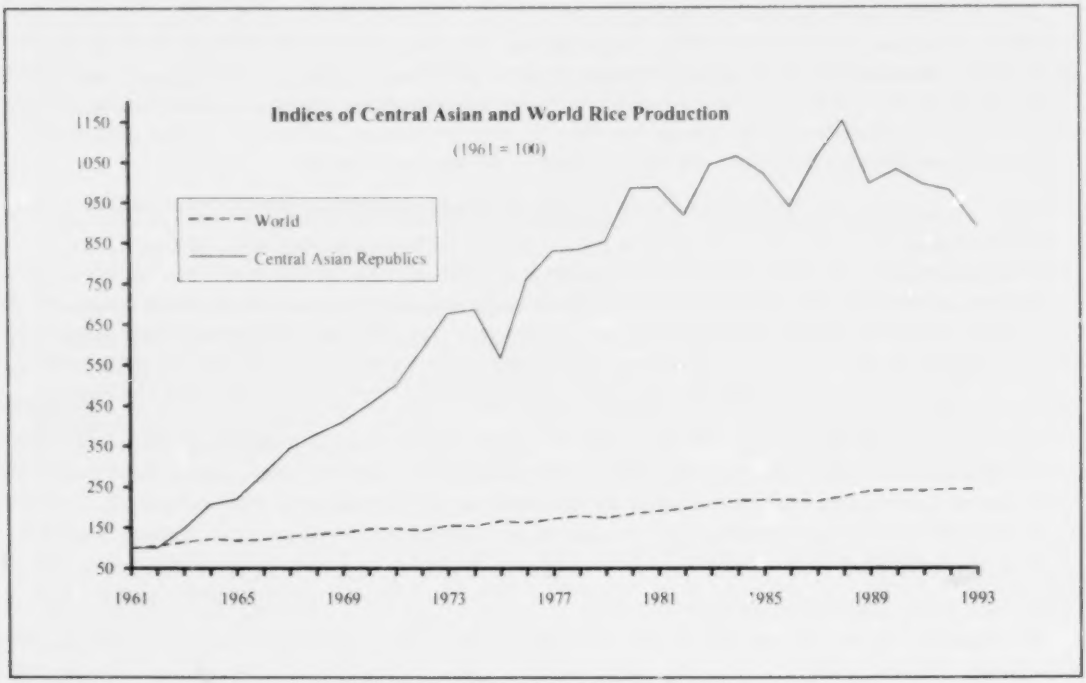


**Figure 1** Source: FAO and UNCTAD databases

20. Rice production grew rapidly in Central Asia up to the mid-1980s. Although starting from a low base, growth was well above the world average during most of the period (see figure 2). Even so, the Soviet import volume soared from 200,000 - 300,000 metric tons annually in the 1960s to 700,000 - 800,000 metric tons at the beginning of the 1980s. Thereafter it declined reaching about 400,000 - 600,000 metric tons per year at the end of the 1980s.[28] In the absence of the rapid expansion of rice production in Central Asia, USSR rice imports would certainly have increased much faster.

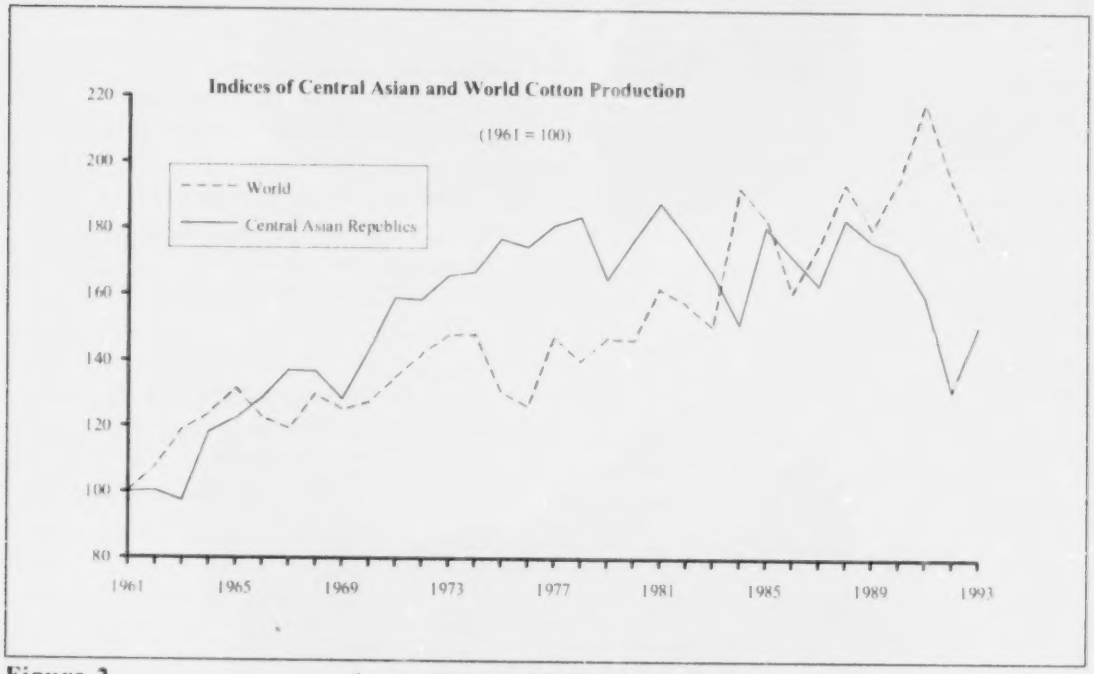


**Figure 2** Source: FAO and UNCTAD databases

21. All Soviet cotton was irrigated production; some 95 per cent was grown in Central Asia. In 1950, only 2.9 million hectares of land in Central Asia had been irrigated. By the late 1980s, the irrigated area had been expanded to about 7.6 million hectares (4.3 million of which lay in Uzbekistan),[29] accounting for 40 per cent of the irrigated land in the former USSR. Some 3 million hectares of irrigated land were devoted to cotton growing. Irrigation is also crucial to fodder and rice production (see figure 3). Irrigation has been the dominant use of water in Central Asia, accounting for about 85 to 95 per cent of water use (excluding reservoir evaporation) in the 1980s.[30] It is not irrigation per se, however, which uses up the river water. The absence of economic incentives to save water and the lack of water monitoring gauges[31] have led to overuse. Actual water consumption exceeded agronomic needs by 1.5 to 2 times.[32] This has set in motion a vicious circle of desiccation of the Aral lake, salinization of soil and decline in biological productivity (yield of aggregate crop and livestock production per hectare) in the Aral Sea Basin.

22. "Aral" in the old Turkic language means "island"; an island of water in the desert sand of the Kara-Kum ("black sand") and Kyzul-Kum ("red sand") deserts. In the late 1950s, Lake

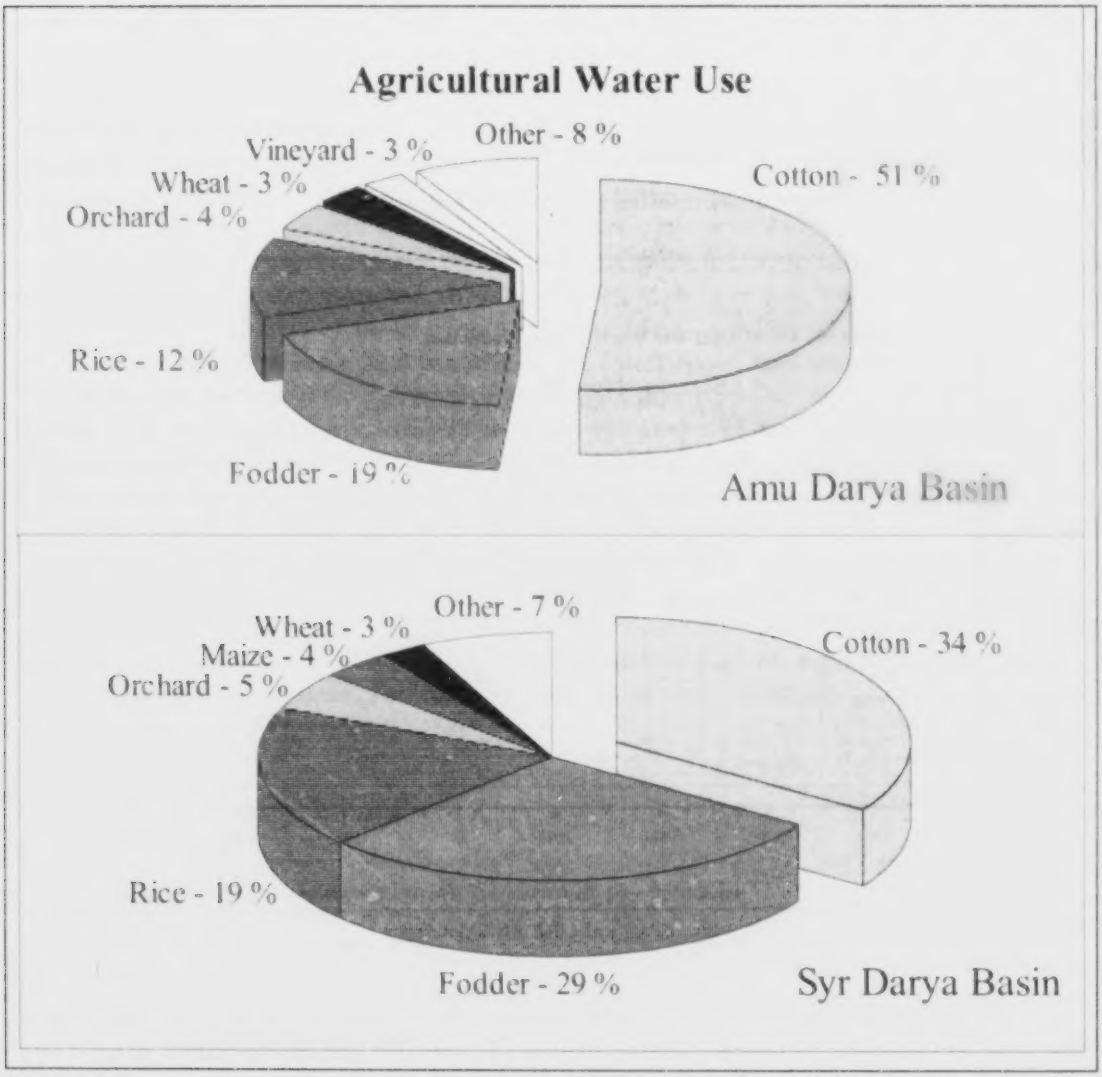


**Figure 3** Source: *The Iranian Journal of International Affairs*, Vol. 5, No. 1, p. 166

Aral was, surface-wise, the fourth largest inland reservoir of water in the world. Since the beginning of the 1960s, the level of Lake Aral has dropped continually and dramatically (see figure 4). Its main town, Aralsk, formerly a port, is now some 100 km from shore. This was a direct result of the reduction in streamflow of the rivers Amu Darya (the Oxus river) and Syr Darya (the mysterious river) which, prior to 1960, used to carry, respectively, about 73 $km^3$ and 37 $km^3$ of water annually.[33] The volume of water that reached the lake each year dropped from approximately 60 $km^3$ at the end of the 1950s to 41 $km^3$ in the 1960s and 7 $km^3$ in the 1980s.[34] In 1982 and 1986, virtually no water reached the lake from either of the rivers. Several observers point out that the reduction in streamflow was, apart from irrigation, to some extent attributable to a natural decrease in precipitation in the Pamir Mountains, in particular during the 1960s.[35] There is, however, a consensus that only 8 to 15 per cent of the

decrease in run-off volumes can be attributed to climatic factors.[36] The two rivers are the heart and lungs of the region. Unlike most great rivers that flow into the world's ocean system, the Amu Darya and Syr Darya form a closed system with the Aral lake. This implies that irrigation practices supportable elsewhere cannot sustainably be maintained in Central Asia.[37] The desiccation of the lake and the drying of branches and arms in the Amu Darya and Syr Darya river deltas are, however, only the most apparent and glaring manifestation of very complex and far-reaching changes in the ecosystem of the Aral Lake Basin.

B. The vicious circle of desiccation, salinization and decline in biological productivity

23. The decline of the water level in the Aral Sea caused by withdrawal of water from the two major rivers in the region has led to many changes in ecological conditions in the Aral basin. As may be seen from figure 4, the salinity of the lake's water increased markedly from the pre-1960 level of 10 g/l to today's high of above 30 g/l, approaching that of sea water in the open ocean. Furthermore, large parts of the lake's previously submerged soils became exposed to wind action, leading to the formation of live sand dune fields. As a result, the frequency and intensity of springtime salt-laden dust storms have increased. These storms, which carry away up to 75 million tons of soil annually, deposit a crop-killing mixture of salt and chemicals on the surrounding farmland at a rate of almost half a ton per hectare each year.[38] In extreme cases, dust carried by these storms has been discovered almost 2000 miles away in the air over Belarus and Latvia.[39]

| Year | Average level (metres) | Average area (sq.-km) | Average volume (cu.-km) | Average salinity (grams/litre) |
|---|---|---|---|---|
| 1960 | 53.41 | 68,000 | 1090 | 10 |
| 1971 | 51.05 | 60,200 | 925 | 7 |
| 1976 | 48.28 | 55,700 | 783 | 14 |
| 1989 | 39.07 | 40,394 | 370 | 30 |
| 2000 | 33.00 | 26,500 | 168 | >70 |

The changing profile of the Aral

**Figure 4** Source: J.M. Stewart, *The Soviet environment problems*, Cambridge, 1992, p. 99

24. In regions of inefficient irrigation and with a lack of adequate drainage, salinization is a major problem. In Turkmenistan, over 90 per cent of the cultivated area is affected by

salinization, over one-third of Uzbekistan's cropland is similarly distressed. The problem has been aggravated by excessive use of chemicals. Irrigation and continuous mono-culture has required an increased use of agro-chemicals. For example, the application of mineral fertilizers on cotton in Uzbekistan in the period 1990 to 1991 totalled 424 kg per hectare, including 230 kg of nitrogen, 128 kg of phosphorus and 66 kg of potassium. In comparison, fertilizer use in Arizona, an area of irrigated cotton production in the United States of America, totalled 286 kg per ha in 1991, while fertilizer applications in Pakistan, another area of irrigated production, amounted to 135 kg per hectare.[40] Likewise, defoliants were often used to facilitate cotton harvesting. In those years, when the major rivers still reached the lake, a significant portion of these chemicals contained in drainage water polluted the waters of the lower reaches of both the rivers and of the lake.

25. The desiccation of the lake and the reduced streamflow of the rivers Amu Darya and Syr Darya caused a drop of the flow of artesian wells and lowered the ground water table around the lake. As a result, the wells and springs in the Aral Sea basin dried up and the degradation of natural plant communities, pastures and hay fields followed.[41] Furthermore, the lowering of the groundwater level compounded the already delicate situation of drinking water supply in the region.

26. The shrinking area and volume of the lake have altered the climate around the Aral Sea. It has become more continental and dryer, with warmer summers, cooler winters and lower humidity, particularly within 50 to 60 km of the former shoreline. The amplitude of the summer and winter air temperatures at coastal stations increased by 1.5 to 2.5 degrees. In addition, mean annual relative air humidity has decreased by two to three per cent and the recurrence of rainless days has increased considerably.[42] Allegedly, this has shortened the growing season on the northern margins of cotton-raising in the Karakalpak region, south of the lake, forcing a switch to rice cultivation.[43] Moreover, spring frosts are now common late in the year, posing serious problems for farmers. In 1989, for example, cold winds brought frost and snow to large areas of Uzbekistan, Tajikistan and Kyrgyzstan at the beginning of May, normally a very warm month. In some areas, 50 cm of snow covered the fields and more than 500,000 hectares of cotton plants were killed.[44]

27. The processes described above have been accompanied by an impoverishment of the flora and fauna in the Aral Sea Basin. Likewise, increasing salinity and the shrinking area and volume of the lake have caused profound changes in its aquatic ecology.[45]

28. Reflecting to a certain extent all of the above outlined individual environmental effects of massive irrigation and monoculture, the biological productivity of the ecological system in Central Asia is estimated to have declined by 30 to 50 per cent.[46] The risk of massive desertification is now acute. Each year, the desert swallows between 800,000 and 1,100,000 hectares of land. The Kara-Kum and Kyzyl-Kum deserts which used to occupy roughly 22 - 24 per cent of the total area of Uzbekistan, Turkmenistan, Kazakhstan and the adjoining territory to the north of the Caspian lake now comprise approximately 35 - 40 per cent of the area.[47]

C. Regaining control of the environmental situation and the consequences for commodity production and trade

29. The newly independent States of Central Asia have a critical water-management problem. The massive development of irrigation and inefficient water use have virtually exhausted surface water resources, placing the future of irrigation-based crops - the region's present agricultural and, to a large extent, economic backbone - in jeopardy. Population continues to grow rapidly, which requires an increasing water and food supply as well as more employment opportunities. In this light, the following question takes on great significance: what are the proposals to regain ecological viability in the Aral Sea Basin and how would they affect commodity production and trade?

30. Plans advanced in the mid-1980s (see figure 5) envisaged taking, at the beginning, some 27 $km^3$ of water from the Ob' and Irtysh rivers in Western Siberia and diverting it 2,500 km southward through the Turgai Gate into the Aral Sea Basin. This plan relied on a proposed system of low dams, pumping stations, and a huge earth-lined canal.[48] Ruling out the implementability of the gigantic diversion of north-flowing Siberian rivers to Central Asia in the foreseeable future for economic and political reasons, the following options seem to be the most realistic: (a) enhancing water efficiency and increasing the return of drainage water into the lake; (b) withdrawing low-production and salinized lands from irrigation and reducing gradually production of water-demanding cotton and rice; (c) diversifying into crops which

Central Asia

I. Uzbekistan
II. Turkmenistan
III. Tajikistan
IV. Kyrgyzstan
V. Kazakhstan
Va. Kzyl Orda area
Vb. Chimkent area

**Figure 5**

worked well in the past, with a view to reinvigorating the economic and ecological development.

31. As far as water efficiency is concerned, water wastage in irrigation in the Aral Sea Basin is undoubtedly enormous. For the early 1980s, it was estimated that only 60 per cent of water withdrawals for irrigation actually reached the fields, the rest got lost in the conveyance system.[49] As outlined above, inefficient use is aggravated by excessive agronomic consumption in the fields, often absorbing up to twice the normal agronomically necessary water volume. To start with, a realistic system for pricing water is imperative. This needs to be supplemented by improving the conveyance system and the installation of sufficient water-monitoring gauges, as well as the proper servicing of canals. Likewise, the system of drainage should be well serviced and, whenever possible and affordable, expanded. The improvement of irrigation efficiency in Central Asia has been viewed as a priority since the beginning of the 1980s and, fortunately, has already produced some results. Average water withdrawals per hectare of irrigated land decreased by 27 per cent between 1980 and 1986, a sizeable part of the savings, however, went to increase the irrigated area by 15 per cent.[50] Lower filtration in the irrigation canals could make available at least 10 - 20 $km^3$ of additional water. Overhead (spray) irrigation and systems of permanent control over soil and air humidity could save an additional 25 - 28 $km^3$ of water per year.[51]

32. It is unavoidable that low-production and salinized lands will have to be withdrawn from irrigation. These lands yield the lowest harvest, while at the same time requiring the highest amount of water. If only five per cent of the land unsuitable to irrigation were removed from irrigation, 7 $km^3$ of water could be saved annually. From an ecological and economic point of view, it is quite possible to withdraw an even larger area from irrigation. Approximately 15 per cent of irrigated land in the Aral Sea Basin is in a very unsatisfactory condition. Its withdrawal from irrigation would save about 15 to 20 $km^3$ of water annually, or even more.[52] It must be stressed, however, that withdrawal of land from irrigation must be accompanied by solving the social and economic problems of population directly or indirectly dependent on these lands.

33. A further element of any programme to regain some control over the ecological situation would be to take full advantage of such agricultural reforms as long-term leasing and self-management in order to diversify the crop structure. If farmers are given the right to determine what they will produce, it is widely expected that a good number of cotton fields will be converted to pasture for livestock, fruit orchards, wheat and vegetable crops. Crops such as wheat and corn, however, do not earn a comparable return per hectare, existing farms are not small enough to manage effectively intensive row crops, such as vegetables, on a large scale. Nevertheless Central Asia has the fastest-growing population in the CIS region. If growth rates remain unchanged, 20 years from now, the population will have nearly doubled to about 60 million. This calls not only for sufficient food production but also for an adequate income and commensurate employment opportunities. Unless the right mix of cash crops, such as cotton, and food crops, as outlined above, is found, there is the risk that a high value item such as opium could gain importance.[53]

D. Impact on production and trade

34. The gradual reduction of cotton and, to a lesser extent, rice growing is widely regarded as an unavoidable measure in order to stabilize the water balance in the Aral Sea Basin in the long term. In the period 1991 to 1993, cotton production had already declined sharply in Uzbekistan, Tajikistan[54] and Kazakhstan, lowering the production volume of all Central Asian republics by approximately 25 per cent as compared to the end of the 1980s.[55] However, most observers predict that given the lack of alternative uses for land and per capita income already relatively low, further declines in cotton areas are unlikely. The cotton area in Central Asia decreased by approximately a quarter in the five-year period between 1988 and 1992 (see figure 6), although it is expected to remain at about 2.6 million hectares during the 1990s.[56] In this light, the lion's share of water savings will have to come from enhanced water efficiency, that is: (a) the drastic reduction of water use in the field to levels that match agronomically justified norms, (b) minimization of water losses in the conveyance system, and (c) increased recuperation of water through drainage.

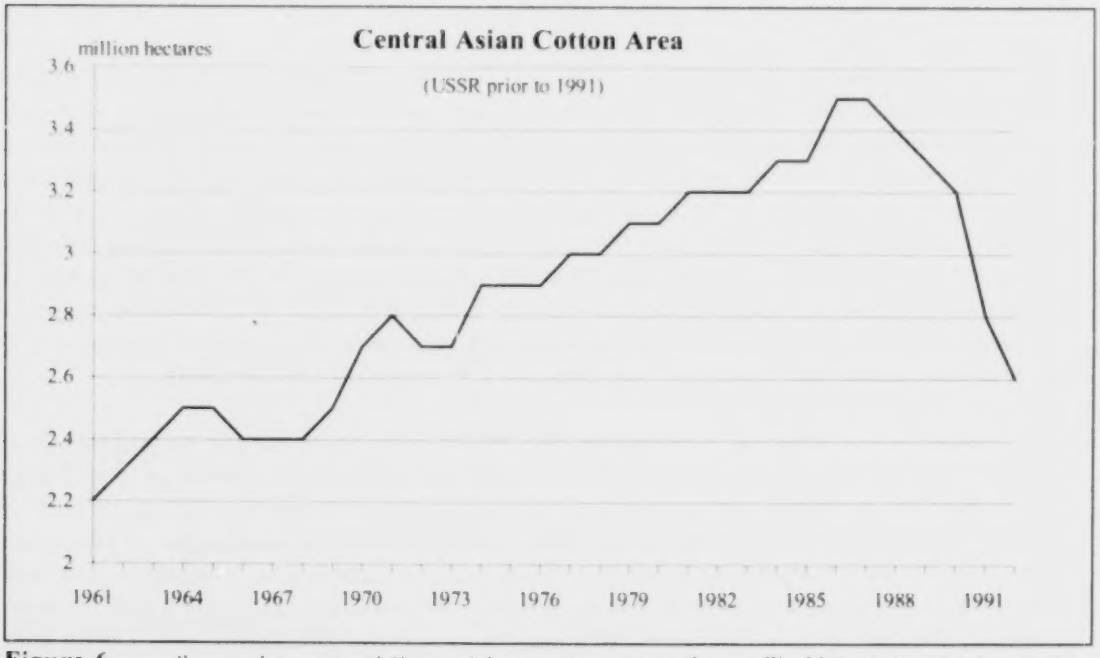


**Figure 6** Source: International Cotton Advisory Committee, *Cotton: World Statistics*, October 1993.

35. Domestic consumption of cotton is forecast to increase because of new foreign investment in domestic textile industries. Domestic mill use can therefore be expected to increase from some 15 per cent of cotton production to about 30 per cent at the end of the century.[57] The rest will be exported.

36. Foreign trade in the newly independent Central Asian republics remains largely centralized. Governments set export quotas, issue licenses for exports of cotton and regulate foreign currency transfers. Frequently, a specific cotton volume or revenue from cotton exports are allocated to state-owned entities to be used to barter for machinery, spare parts

and other vital inputs such as fuel, wood and food. The Russian Government, for example, signed an agreement on cotton-for-oil barter for 1993 with Central Asian countries covering 382,000 tons of cotton.[58]

37. The break-up of the Eastern bloc and the Soviet Union has led to considerable changes in the regional patterns of trade in Central Asia. Exports to other CIS republics are estimated to have decreased by between 10 and 60 per cent.[59] Cotton consumption of Russian mills, for example, dwindled from some 900,000 tons in 1991 to about 660,000 tons in 1992. Consumption in the Ukraine was estimated at 100,000 tons in 1992, compared with 171,000 the previous season.[60] Likewise, Central Asian exports to the former CMEA member countries contracted from 550,000 tons in 1990 to 150,000 tons in 1991/92. In contrast, exports to other countries leaped from 180,000 tons in 1990 to about 465,000 tons in 1991/92. Exports to Western Europe reached a record of 273,000 tons, with France, Germany and Italy accounting for 220,000 tons. Central Asia became a substantial exporter of cotton to Turkey in 1992/93. Exports to Japan, Brazil, Mexico and Turkey rose strongly as well.[61]

38. The Central Asian republics are expected to remain one of the major sources of world cotton supplies, accounting for about one-third of world cotton exports. Despite the environmental pressure, it is safe to assume an annual export volume of about 1.6 to 1.8 million tons of cotton for Central Asia in the next few years. If current trends in the regional patterns of cotton trade continue, about one million tons would be shipped to non-CIS countries annually, leaving no more than 600,000 - 800,000 tons for cotton mills in Russia and the Ukraine.[62] If half of the cotton manufacturing facilities there were to remain idle, Russia and the Ukraine would have little alternative but to step up cotton imports from non-traditional sources. This scenario is all the more likely as cotton mills and the textile industry in Russia and the Ukraine, with the supplementary help of foreign capital, may be in a good competitive position on Western European markets. Under this scenario, it is also not unlikely that cotton imports from Central Asia will rebound as soon as the financial, currency and administrative calamities hindering trade between CIS republics are overcome.

39. As far as rice growing is concerned, the Central Asian republics and Kazakhstan used to account for about half the volume of rice produced in the USSR. As compared to all States forming the CIS, this share had increased to 55 per cent during the period 1991 to 1993; CIS production declined while Central Asian output remained almost unchanged. While trade figures are not as yet available, it seems unlikely that any decline in rice production will affect trade, as shipments to Russia used to be small and will most likely dry up in the light of soaring domestic demand fuelled by high population growth. This might leave Russia with little alternative but to increase imports from other sources.

## CONCLUSIONS

40. If several of the measures outlined above were to be introduced without further delay, the best one could expect would be to achieve a stabilization of the lake's water level at approximately 32 - 34 metres by the turn of the century. This would require a water inflow of about 21 - 25 $km^3$ a year, more than three times the average annual rate of the 1980s.[63] Furthermore, drainage water would have to be desalinated and detoxified in order to arrest the

rise of salinity of the lake's water. An increase of inflow into the lake is certainly the most important measure to contain deterioration of the grave environmental situation, it will however not cure the subsidiary environmental effects triggered by desiccation which, in particular, affect overall agricultural productivity. The complex nature and magnitude of the problem calls for close inter-regional collaboration and international assistance.

## Notes

1. Discounting price subsidies, the production and processing of commodities such as fuels, timber and metals represented about 20 per cent of the total industrial output in the USSR while the corresponding figure for the United States was 5.8 per cent, for Germany it was 2.6 per cent and for Japan 0.3 per cent.
Zeev Wolfson, Natural resources development: an economic and environmental problem in the USSR, *Communist Economies*, Vol. 1, No. 1, London, 1989, p. 79.

2. Gordon Hughes, Clean air but no jobs? Environmental priorities and policies during the transition in Central and Eastern Europe, IEA/OECD, Conference on energy and environment in European economies in transition, Proceedings, Prague, June 1992, pp. 66 - 67.

3. Economic Commission for Europe, The environment in the USSR: economics and ecology, Report to the second session of the Joint Working Group on Environment and Economics of the Senior Advisers on Environmental and Water Problems and the Senior Economic Advisers to ECE Governments (ENVWA/WG.2/R.9,EC.AD/WG.1/R.9),Geneva, 26 August 1991, p. 2.

4. UNCTAD, Commodity Yearbook 1993, TD/B/CN.1/STAT/1, New York, 1993, p. 85.

5. For more details, see: Economic Commission for Europe, Economic Survey of Europe in 1992-1993, New York and Geneva, 1993, pp. 115 - 119.

6. Gordon Hughes, Cleaning up Eastern Europe, *Finance and Development*, Washington, September 1992, p. 17.

7. For more information, see: Axel Hörhager, An environmental perspective for Eastern Europe, European Investment Bank, EIP Papers, No. 18, London, November 1992, pp. 35 - 57.

8. According to Marx, the value of a product is based on the amount of socially necessary labour (in terms of quantity, quality and skills) spent on its production.

9. The State, as "administrator" of public property and social wealth, found it difficult to implement the scarcity rent because this would have placed a burden on society - the owner of natural resources. Moreover, the resources rent was regarded as a surcharge of the "socially justified production price" appropriated by the owner of the land/resource.

10. By way of illustration, even when converted at heavily overvalued exchange rates, energy prices charged in the states of the former USSR reached only about 20 per cent of those in Western Europe (Hughes, op. cit., p. 17).

11. If converted at the official rate, the domestic price of oil in Russia, for instance, was only 18 to 21 per cent of the world market price in the first half of 1993.
Economic Commission for Europe, Economic Bulletin for Europe, Volume 45 (1993), Geneva 1994, p. 72.

12. Unlike the USSR which regarded gross output as the key variable of plan performance until its breakdown, most other former socialist countries in Europe gradually switched, starting in the early 1970s, to a performance evaluation system that placed more emphasis on profitability.

13. Wolfson, op. cit., p. 85.

14. Hilary F. French, Green revolutions: environmental reconstruction in Eastern Europe and the Soviet Union, *Columbia Journal of World Business*, No. 26, Spring 1991, p. 31.

15. ECE, The environment in the USSR: economics and ecology, op. cit., p. 4.

16. Other reform elements of a supplementary character are the setting up of regulatory frameworks for enterprises, the liberalization of currency and exchange rate policies and the establishment of banking and capital markets systems. Hörhager, op. cit., p. 42.

17. Hughes, Clean air but no jobs?, op.cit., pp. 71 - 72.

18. Although in the case of Russia "strategic commodities" such as oil, gas or metals are excluded from barter deals, the share of barter in exports is estimated to have reached 30 per cent of total exports and 50 per cent of imports in 1992.
ECE, Economic Bulletin for Europe, Volume 45, op.cit., p. 71.

19. In several cases, the strong incentives for export had to be constrained with an export tax levied by Russian authorities on a number of fuel products and metals.

20. For more information in this regard, see: ECE, Economic Survey of Europe in 1992 - 1993, op. cit., p. 119.

21. Ibid., p. 133.

22. Russia's value gap, *Economist*, London, 24 October 1992.

23. It is estimated that in mid-1993 approximately 25 - 40 per cent of the ferrous metal processing industry together with 40 - 65 per cent of the non-ferrous capacity was idle.
*Financial Times*, London, 19.8.1993.

24. Russia's value gap, op. cit.
In Russia, for example, no systematic commodity statistics of trade are available, but preliminary estimates for 1993 indicate that the export of raw materials accounted for some 68 per cent (fuels - 53%, other raw materials and semi-fabricates - 15%) while that of machinery and equipment accounted for about 7 per cent of all exports. In contrast, in the mid-1980s, raw materials accounted for some 57 per cent of Soviet exports (fuels: 46 - 48%, other raw materials and semi-manufactures: 10 - 12%) while machinery and equipment accounted for some 15 per cent.
UNCTAD dada base, ECE, Economic Bulletin for Europe, Volume 45, op.cit., p. 72.

25. Central Asia comprises the now independent republics of Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

26. Cotton exports rose from about 400,000 tons annually in the early 1960s to 1 - 1.2 million metric tons in the mid-1980s. FAO, Trade Yearbook, Rome, various issues.

27. Uzbekistan alone produced more than three-fifths of the total cotton production in the former Soviet Union.

28. Ibid.

29. A. Ye. Anayev, Aral: anatomy of a dying sea, *Soviet Life*, Vol 8, No. 395, August 1989, p. 14; A way of life evaporates - water politics in the Soviet south, in: *Economist*, London, 21. 9. 1991.

30. Philip P. Micklin, Water management in Soviet Central Asia: problems and prospects, in: J. M. Stewart, *The Soviet environment: problems, policies and politics*, Cambridge, 1990, pp. 91 - 93.

31. Panel on the state of the Soviet environment at the start of the nineties, *Soviet Geography*, Volume 31, No. 1, p. 425.

32. The agronomic standard established by researchers in field trials is 9,000 to 13,000 cubic metres of water per hectare of cotton, equivalent to watering fields to a depth of between 0.9 and 1.3 metres each season. The ratio of effective use to total amount of water delivered to the field is estimated at about 0.55 to 0.70.
Dourbek K. Akhmedov, Cotton production policies in Central Asia, in: *Cotton: Review of the World Situation*, International Cotton Advisory Committee, May - June 1993, p. 10.

33. Only about 50 per cent of this water volume reached the lake in the light of high evaporation and transpiration.
Michael H. Glantz, Alvin Z. Rubinstein, Igor Zonn, Tragedy in the Aral Sea Basin: looking back to plan ahead?, *Iranian Journal of International Affairs*, Volume 5, No. 1, Spring 1993, p. 165.

34. Ulrich Weißenburger, Umweltprobleme in den Nachfolgestaaten der UdSSR, Bundesinstitut für ostwissenschaftliche und internationale Studien, Cologne, 1993, pp. 115 - 116.

35. N. V. Aladin, The changes in the Aral Sea ecosystems during the last thirty years, Paper presented to the conference of the University of Indiana on "The Aral Sea Crisis: Environmental Issues in Central Asia", Bloomington, 1990, p. 1.

36. UNEP, *The Aral Sea: Diagnostic Study for the Development of an Action Plan for the Conservation of the Aral Sea*, Nairobi 1993, p. 46.

37. A way of life evaporates - water politics in the Soviet south, op. cit.

38. French, op. cit., p. 36.

39. Bridget Morris, The death of the Aral Sea, *Multinational Monitor*, Volume 11, No. 9, September 1990, p. 14.

40. Akhmedov, op. cit., p. 10.

41. Micklin, op. cit., p. 103.

42. UNEP, op.cit., pp. 43 - 44.

43. Ibid., p. 103.

44. Zhores A. Medvedev, The environmental destruction of the Soviet Union, *The Ecologist*, Volume 20, No. 1, January/February 1990, p. 27.

45. For more detail, see: UNEP, op.cit., pp. 48 - 52 and 62 - 68.

46. A. Reteyum, Srednaya Aziya i Kazakhstan, *Kommunist*, No. 14, 1989, p. 33.

47. Wolfson, op. cit., p. 61.

48. Micklin, op. cit., p. 105.

49. *Pravda*, 14 April 1988, p.3.

50. Micklin, op. cit., p.95.

51. UNEP, op.cit., p. 97.

52. Ibid., p. 95.

53. A way of life evaporates - water politics in the Soviet south, op. cit.

54. In the case of Tajikistan, a year of fighting prevented the harvest of 70 per cent of the 1992-93 cotton crop. *Financial Times*, London, 19.3.1993.

55. Cotton Advisory Committee, *Cotton: World Statistics*, October 1993, pp. 33 - 35; FAO, Production Yearbook, 1993, Volume 47, Rome, 1994.

56. Akhmedov, op. cit., p. 11.

57. Ibid., pp. 11 - 12.

58. International Cotton Advisory Committee, *Cotton: Review of the World Situation*, November - December 1993, p.13.

59. Ibid., September - October 1993, p. 16.

60. Ibid. and November - December 1993, p. 13.

61. Ibid., January - February 1993, p. 8 and January - February 1994, p. 7.

62. Ibid.

63. Micklin, op.cit., p. 108.